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EXAMINER
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ART UNIT	PAPER NUMBER
2154	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/934,059	GAIKWAD ET AL.	
	Examiner	Art Unit	
	Aaron Perez-Daple	2154	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This Action is in response to RCE filed 4/26/04, which has been fully considered.

2. Original claims 1-27 are presented for examination.

3. This Action is non-Final.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. **Claims 1-25** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, in claims 1 and 25 it is unclear whether the recited "process input control signal," which is claimed as provided by the controller, is separate from the "controller output signal" recited in the step of calculating. Referring to Applicant's Fig. 1, which shows only a single "controller output signal" used as an input to the process, the Examiner interprets that the "process input control signal" and the "controller output signal" may be the same signal. Moreover, it is not clear whether the "process input control signal" used in the step of calculating includes the disturbance or not. The Examiner interprets that either including or *not* including the disturbance falls within the scope of the claim.

6. As dependent claims, claims 2-24 suffer from the same deficiencies as claim 1.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. **Claims 1-12, 14-20 and 25-27** are rejected under 35 U.S.C. 102(b) as being anticipated by Nishikawa et al (Nishikawa et al., "A Method for Auto-Tuning of PID Control Parameters", Automatica, vol. 20, no. 3, pp. 321-332, 1984.) (hereinafter Nishikawa).

As for claims 1 and 25, Nishikawa discloses a method and a tuning device for determining one or more new gains for a controller while the controller continues to control a process towards a target loop transfer function (Section 4.1, pgs. 325-326, "First, we summarize...without the derivate of J proposed by Zangwill (1967)."), the controller receiving a process output signal (x, Fig. 3) and a process set point signal (R, Fig. 3) and providing a process input control signal (Fig. 3), the method comprising the steps of:

introducing a disturbance into the process input control signal (pg. 323, "In contrast with these...desires to apply it."; N', Fig. 3);

calculating one or more new gains for the controller using a controller output signal, the process input control signal, and the target loop transfer function (Section 3.2, pgs. 324-325, "The closed-loop procedure...is omitted here."); and

using the one or more new gains in the controller to subsequently control the process (Section 1, pgs. 321-322, "In the last few years...gives some concluding remarks.").

9. As for claim 2, Nishikawa discloses the method of claim 1, wherein the one or more new gains for the controller are determined without using a model of the process (Section 2, "A tuning procedure...have no interaction.").

10. As for claim 3, Nishikawa discloses the method of claim 1, wherein said gains include a proportional gain (Table 4, pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

11. As for claim 4, Nishikawa discloses the method of claim 1, wherein said gains include an integral gain (Table 4, pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

12. As for claim 5, Nishikawa discloses the method of claim 1, wherein said gains include a derivative gain (Table 4, pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

13. As for claim 6, Nishikawa discloses the method of claim 1, wherein the target loop transfer function is indicative of a desired response of the process (Section 4.1, pgs. 325-326, "First, we summarize...without the derivate of J proposed by Zangwill (1967).").

14. As for claim 7, Nishikawa discloses the method of claim 6, wherein the target loop transfer function is a first-order transfer function (Section 2, "A tuning procedure...because the actions of P, I and D have no interaction.").

15. As for claim 8, Nishikawa discloses the method of claim 6, wherein the target loop transfer function is a second-order transfer function (Section 2, "A tuning procedure...because the actions of P, I and D have no interaction."; Section 4.2, "Let us examine...the control of real processes.")

16. As for claim 9, Nishikawa discloses the method of claim 1, wherein the process is controlled within a desired closed-loop control bandwidth (Section 3.2, pgs. 324-325, "The closed-loop procedure...is omitted here.").

17. As for claim 10, Nishikawa discloses the method of claim 9, wherein the desired closed-loop control bandwidth is indicative of a desired settling time for the process (Fig. 4, Section 3.2, pgs. 324-325, "The closed-loop procedure...is omitted here.").

18. As for claim 11, Nishikawa discloses the method of claim 9, wherein the desired closed-loop control bandwidth is indicative of a time constant for the process (Fig. 4, Section 3.2, pgs. 324-325, "The closed-loop procedure...is omitted here.").

19. As for claim 12, Nishikawa discloses the method of claim 1, wherein the disturbance includes one or more step changes (pg. 324, "Figure 3 shows a block diagram...of x(t) and y(t), respectively.").

20. As for claim 14, Nishikawa discloses the method of claim 1, wherein the disturbance includes a white noise signal that is band-pass filtered and clipped (N, Fig. 1).

21. As for claim 15, Nishikawa discloses the method of claim 1, wherein the disturbance is introduced into the controller output signal causing a response in the process input control signal (Fig. 3; pg. 324, "Figure 3 shows a block diagram...of x(t) and y(t), respectively.").

22. As for claim 16, Nishikawa discloses the method of claim 1, wherein the controller uses one or more new gains to produce the controller output signal (Table 4, pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

23. As for claim 17, Nishikawa discloses the method of claim 16, wherein the controller output signal comprises a proportional error (pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

24. As for claim 18, Nishikawa discloses the method of claim 16, wherein the controller output signal comprises an integral error (Table 4, pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

25. As for claim 19, Nishikawa discloses the method of claim 16, wherein the controller output signal comprises a derivative error (Table 4, pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

26. As for claim 20, Nishikawa discloses the method of claim 1, wherein the process input control signal is the sum of the controller output and the disturbance (Fig. 3; pg. 324, "Figure 3 shows a block diagram...of x(t) and y(t), respectively.").

27. As for claims 26 and 27, Nishikawa discloses a method and a tuning device for determining one or more new gains for a controller while the controller continues to control a process towards a target loop transfer function (Section 4.1, pgs. 325-326, "First, we summarize...without the derivate of J proposed by Zangwill (1967)."), the controller receiving a process output signal (x, Fig. 3) and a process set point signal (R, Fig. 3) and providing a controller output signal (y, Fig. 3), the method comprising the steps of:

introducing a disturbance into the controller output signal causing a response in a process input control signal (pg. 323, "In contrast with these...desires to apply it."; N', Fig. 3);

calculating one or more new gains for the controller using the controller output signal, the response in the process input control signal, and the target loop transfer function (Section 3.2, pgs. 324-325, "The closed-loop procedure...is omitted here."); and

using the one or more new gains in the controller to subsequently control the process (Section 1, pgs. 321-322, "In the last few years...gives some concluding remarks.").

Claim Rejections - 35 USC § 103

28. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

29. **Claim 13** is rejected under 35 U.S.C. 103(a) as being obvious over Nishikawa in view of Stoddard et al (US 5,895,596) (hereinafter Stoddard). Although obvious to one of ordinary skill in the art, Nishikawa does not specifically teach the use of a disturbance comprising a pseudo random binary sequence. However, Stoddard teaches the use of a disturbance comprising a pseudo random binary sequence (cols. 8-9, In a characterization control...implemented in statespace form.").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Nishikawa by using a pseudo random binary sequence as the disturbance in order to allow for reliable identification of control parameters in a thermal reactor and for design simplicity, as taught by Stoddard (cols. 10-11, "The identification or characterization...outputs are measured.").

30. **Claims 13** is rejected under 35 U.S.C. 103(a) as being obvious over Nishikawa in view of Grassi (E. Grassi, "Proportional-Integral-Derivative Controller Tuning by Frequency Loop-Shaping," Ph.D. dissertation, Arizona State University, December 1999.) (hereinafter Grassi).

Nishikawa does not specifically teach the use of a disturbance comprising a pseudo random binary sequence. However, Grassi teaches the use of a disturbance comprising a pseudo random binary sequence (pgs. 29-30, "Good input signal...drift in the output occurs.").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Nishikawa by using a pseudo random binary sequence as the disturbance in order to provide the excitation required to tune the controller parameters, as taught by Grassi (pgs. 29-30, "Good input signal...drift in the output occurs.").

31. **Claims 21-24** are rejected under 35 U.S.C. 103(a) as being obvious over Nishikawa in view of Grassi et al (Grassi et al, "PID Controller Tuning by Frequency Loop-Shaping," Proc. 35th Conference on Decision and Control, Japan, December 1996.) (hereinafter Grassi II).

As for claim 21, although Nishikawa teaches minimization of an error term that is arguably equivalent to Applicant's equation 6, Nishikawa does not specifically teach minimization of Applicant's equation 6. However, Grassi II teaches the minimization of an equivalent expression to applicant's equation 6 (Section 2.3, "The tuning of the...with a suitable initialization.").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Nishikawa by minimizing an expression for the error between the desired closed loop response and actual closed loop response, such as applicant's equation 6, in order to find an optimal tuning of the controller gains, as taught by Grassi II (Section 2.3, "The tuning of the...with a suitable initialization.").

32. As for claim 22, Nishikawa teaches a method similar to claim 21, wherein the sum total is minimized by curve fitting using recursive least squares technique (Sections 4.1-4.3, "First, we summarize...for the PID control.").

33. As for claim 23, Nishikawa teaches a method similar to claim 21, wherein the sum total is minimized by curve fitting said sum total using recursive least squares technique with one or more constraints (Sections 4.1-4.3, "First, we summarize...for the PID control.").

34. As for claim 24, Nishikawa teaches a method similar to claim 23, wherein the recursive least squares technique constraint comprises positive values for the one or more new gains for the controller (Sections 4.1-4.3, "First, we summarize...for the PID control.").

Response to Arguments

102 Claim Rejections

35. Applicant's arguments filed 4/26/04 have been fully considered but they are not persuasive.

36. Specifically, with respect to the Nishikawa reference, Applicant asserts that Nishikawa fails to disclose "calculating one or more gains for the controller using a controller output signal, the process control input control signal, and the target loop transfer function." With respect to claims 1 and 25, the Examiner's interpretation is detailed in the 112 rejection above. Under this interpretation, the controller output signal y of Fig. 3 anticipates both the controller output signal and the process input control signal.

On the other hand, claims 26 and 27 are more clear with respect to the distinction between the recited "controller output signal" and the "process input control signal." Namely, the process input control signal is the controller output signal with an added disturbance. The Examiner finds that Nishikawa also meets the limitations of these claims. It is clear from Fig. 3 that the controller output signal y is provided to the auto-tuner. Also, the auto-tuner provides the disturbance signal N' which is added to the controller output signal, y. Therefore, the disturbance signal is known to the auto-tuner (e.g. it has already been provided). The "process input control signal" is merely the sum of the known controller output signal and the known disturbance signal, therefore it is also known to the auto-tuner. Moreover, the claims merely recite "calculating" by "using" these values and do not require separately providing

them (although, it could also be argued that they have been provided). Sections 3.2 and 4 describe such a calculation process.

Applicant further asserts that Nishikawa fails to teach the limitation "towards a target loop transfer function." The Examiner notes that Nishikawa teaches *minimizing* the weighted squared error. The transfer function having minimal squared error is therefore the "target loop transfer function," which falls within the scope of the broadest reasonable interpretation of the claims. The claims do not recite any limitation regarding fitting the gains to a shape nor is there any suggestion in the claims that "towards a target loop transfer function" requires fitting the gains to a shape. Therefore these arguments are moot.

The Examiner notes that the scope of claims 1, 25, 26 and 27 includes both with and without using a model, since the claims have no specific limitations regarding the use of a model.

For all the reasons above, claims 1-12, 14-20 and 25-27 are properly rejected under 35 USC 102(b) as being anticipated by Nishikawa.

103 Claim Rejections

37. Applicant's arguments with respect to claims 13 and 21-24 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

38. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aaron Perez-Daple whose telephone number is 703-305-4897. The examiner can normally be reached on 9am - 6pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Follansbee can be reached on 703-305-8498. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

6/8/04

Aaron Perez-Daple

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